<110> ADNEY, WILLIAM S.
      DING, SHI-YOU
      MCCARTER, SUZANNE
      HIMMEL, MICHAEL E.
      DECKER, STEPHEN R.
      VINZANT, TODD B.

<120> THERMAL TOLERANT EXOGLUCANASE FROM ACIDOTHERMUS
      CELLULOLYTICUS

<130> 40197.5US01

<140> 09/917,384
<141> 2001-07-28

<160> 11

<170> PatentIn Ver. 2.1

<210> 1
<211> 1121
<212> PRT
<213> Acidothermus cellulolyticus

<400> 1
Met Pro Gly Leu Arg Arg Arg Leu Arg Ala Gly Ile Val Ser Ala Ala
  1   5   10   15

Ala Leu Gly Ser Leu Val Ser Gly Leu Val Ala Val Ala Pro Val Ala
             20   25   30

His Ala Ala Val Thr Leu Lys Ala Gln Tyr Lys Asn Asn Asp Ser Ala
             35   40   45

Pro Ser Asp Asn Gln Ile Lys Pro Gly Leu Gln Leu Val Asn Thr Gly
     50   55   60

Ser Ser Ser Val Asp Leu Ser Thr Val Thr Val Arg Tyr Trp Phe Thr
 65   70   75   80

Arg Asp Gly Gly Ser Ser Thr Leu Val Tyr Asn Cys Asp Trp Ala Ala
                 85   90   95

Met Gly Cys Gly Asn Ile Arg Ala Ser Phe Gly Ser Val Asn Pro Ala
             100   105   110

Thr Pro Thr Ala Asp Thr Tyr Leu Gln Leu Ser Phe Thr Gly Gly Thr
         115   120   125

Leu Ala Ala Gly Gly Ser Thr Gly Glu Ile Gln Asn Arg Val Asn Lys
     130   135   140

Ser Asp Trp Ser Asn Phe Asp Glu Thr Asn Asp Tyr Ser Tyr Gly Thr
145   150   155   160

Asn Thr Thr Phe Gln Asp Trp Thr Lys Val Thr Val Tyr Val Asn Gly
              165   170   175

Val Leu Val Trp Gly Thr Glu Pro Ser Gly Ala Thr Ala Ser Pro Ser
              180   185   190

Ala Ser Ala Thr Pro Ser Pro Ser Ser Ser Pro Thr Thr Ser Pro Ser
          195   200   205

Ser Ser Pro Ser Pro Ser Ser Ser Pro Thr Pro Thr Pro Ser Ser Ser
      210   215   220

Ser Pro Pro Pro Ser Ser Asn Asp Pro Tyr Ile Gln Arg Phe Leu Thr
225   230   235   240

Met Tyr Asn Lys Ile His Asp Pro Ala Asn Gly Tyr Phe Ser Pro Gln
              245   250   255

Gly Ile Pro Tyr His Ser Val Glu Thr Leu Ile Val Glu Ala Pro Asp
          260   265   270

Tyr Gly His Glu Thr Thr Ser Glu Ala Tyr Ser Phe Trp Leu Trp Leu
          275   280   285

Glu Ala Thr Tyr Gly Ala Val Thr Gly Asn Trp Thr Pro Phe Asn Asn
      290   295   300

Ala Trp Thr Thr Met Glu Thr Tyr Met Ile Pro Gln His Ala Asp Gln
305   310   315   320

Pro Asn Asn Ala Ser Tyr Asn Pro Asn Ser Pro Ala Ser Tyr Ala Pro
              325   330   335

Glu Glu Pro Leu Pro Ser Met Tyr Pro Val Ala Ile Asp Ser Ser Val
          340   345   350

Pro Val Gly His Asp Pro Leu Ala Ala Glu Leu Gln Ser Thr Tyr Gly
          355   360   365

Thr Pro Asp Ile Tyr Gly Met His Trp Leu Ala Asp Val Asp Asn Ile
      370   375   380

Tyr Gly Tyr Gly Asp Ser Pro Gly Gly Gly Cys Glu Leu Gly Pro Ser
385   390   395   400

Ala Lys Gly Val Ser Tyr Ile Asn Thr Phe Gln Arg Gly Ser Gln Glu
              405   410   415

Ser Val Trp Glu Thr Val Thr Gln Pro Thr Cys Asp Asn Gly Lys Tyr
          420   425   430

Gly Gly Ala His Gly Tyr Val Asp Leu Phe Ile Gln Gly Ser Thr Pro
      435   440   445

Pro Gln Trp Lys Tyr Thr Asp Ala Pro Asp ·Ala Asp Ala Arg Ala Val
      450   455   460

```
Gln Ala Ala Tyr Trp Ala Tyr Thr Trp Ala Ser Ala Gln Gly Lys Ala
465              470              475              480

Ser Ala Ile Ala Pro Thr Ile Ala Lys Ala Ser Gln Thr Gly Asp Tyr
                 485              490              495

Leu Arg Tyr Ser Leu Phe Asp Lys Tyr Phe Lys Gln Val Gly Asn Cys
             500              505              510

Tyr Pro Ala Ser Ser Cys Pro Gly Ala Thr Gly Arg Gln Ser Glu Thr
         515              520              525

Tyr Leu Ile Gly Trp Tyr Tyr Ala Trp Gly Gly Ser Ser Gln Gly Trp
    530              535              540

Ala Trp Arg Ile Gly Asp Gly Ala Ala His Phe Gly Tyr Gln Asn Pro
545              550              555              560

Leu Ala Ala Trp Ala Met Ser Asn Val Thr Pro Leu Ile Pro Leu Ser
             565              570              575

Pro Thr Ala Lys Ser Asp Trp Ala Ala Ser Leu Gln Arg Gln Leu Glu
         580              585              590

Phe Tyr Gln Trp Leu Gln Ser Ala Glu Gly Ala Ile Ala Gly Gly Ala
    595              600              605

Thr Asn Ser Trp Asn Gly Asn Tyr Gly Thr Pro Pro Ala Gly Asp Ser
    610              615              620

Thr Phe Tyr Gly Met Ala Tyr Asp Trp Glu Pro Val Tyr His Asp Pro
625              630              635              640

Pro Ser Asn Asn Trp Phe Gly Phe Gln Ala Trp Ser Met Glu Arg Val
             645              650              655

Ala Glu Tyr Tyr Tyr Val Thr Gly Asp Pro Lys Ala Lys Ala Leu Leu
         660              665              670

Asp Lys Trp Val Ala Trp Val Lys Pro Asn Val Thr Thr Gly Ala Ser
         675              680              685

Trp Ser Ile Pro Ser Asn Leu Ser Trp Ser Gly Gln Pro Asp Thr Trp
    690              695              700

Asn Pro Ser Asn Pro Gly Thr Asn Ala Asn Leu His Val Thr Ile Thr
705              710              715              720

Ser Ser Gly Gln Asp Val Gly Val Ala Ala Ala Leu Ala Lys Thr Leu
             725              730              735

Glu Tyr Tyr Ala Ala Lys Ser Gly Asp Thr Ala Ser Arg Asp Leu Ala
         740              745              750

Lys Gly Leu Leu Asp Ser Met Trp Asn Asn Asp Gln Asp Ser Leu Gly
    755              760              765
```

```
Val Ser Thr Pro Glu Thr Arg Thr Asp Tyr Ser Arg Phe Thr Gln Val
    770                 775             780

Tyr Asp Pro Thr Thr Gly Asp Gly Leu Tyr Ile Pro Ser Gly Trp Thr
785                 790             795                 800

Gly Thr Met Pro Asn Gly Asp Gln Ile Lys Pro Gly Ala Thr Phe Leu
                805             810                 815

Ser Ile Arg Ser Trp Tyr Thr Lys Asp Pro Gln Trp Ser Lys Val Gln
            820             825             830

Ala Tyr Leu Asn Gly Gly Pro Ala Pro Thr Phe Asn Tyr His Arg Phe
        835             840             845

Trp Ala Glu Ser Asp Phe Ala Met Ala Asn Ala Asp Phe Gly Met Leu
    850             855             860

Phe Pro Ser Gly Ser Pro Ser Pro Thr Pro Ser Pro Thr Pro Thr Ser
865             870             875             880

Ser Pro Ser Pro Thr Pro Ser Ser Ser Pro Thr Pro Ser Pro Ser Pro
            885             890             895

Ser Pro Thr Gly Asp Thr Thr Pro Pro Ser Val Pro Thr Gly Leu Gln
        900             905             910

Val Thr Gly Thr Thr Thr Ser Ser Val Ser Leu Ser Trp Thr Ala Ser
        915             920             925

Thr Asp Asn Val Gly Val Ala His Tyr Asn Val Tyr Arg Asn Gly Thr
    930             935             940

Leu Val Gly Gln Pro Thr Ala Thr Ser Phe Thr Asp Thr Gly Leu Ala
945             950             955             960

Ala Gly Thr Ser Tyr Thr Tyr Thr Val Ala Ala Val Asp Ala Ala Gly
            965             970             975

Asn Thr Ser Ala Gln Ser Phe Ala Gly Asp Ser Asp Asp Gly Ile Ala
            980             985             990

Val Ala Ser Pro Ser Pro Ser Pro Thr Pro Thr Ser Ser Pro Ser Pro
        995             1000            1005

Thr Pro Ser Pro Thr Pro Ser Pro Thr Ser Thr Ser Gly Ala Ser Cys
    1010            1015            1020

Thr Ala Thr Tyr Val Val Asn Ser Asp Trp Gly Ser Gly Phe Thr Thr
1025            1030            1035            1040

Thr Val Thr Val Thr Asn Thr Gly Thr Arg Ala Thr Ser Gly Trp Thr
            1045            1050            1055

Val Thr Trp Ser Phe Ala Gly Asn Gln Thr Val Thr Asn Tyr Trp Asn
        1060            1065            1070
```

Thr Ala Leu Thr Gln Ser Gly Lys Ser Val Thr Ala Lys Asn Leu Ser
        1075   1080   1085

Tyr Asn Asn Val Ile Gln Pro Gly Gln Ser Thr Thr Phe Gly Phe Asn
     1090   1095   1100

Gly Ser Tyr Ser Gly Thr Asn Thr Ala Pro Thr Leu Ser Cys Thr Ala
1105   1110   1115   1120

Ser

<210> 2
<211> 3365
<212> DNA
<213> Acidothermus cellulolyticus

<400> 2
atgccaggat tacgacggcg actccgcgcc ggtatcgtct cggcggcggc gttggggtcg 60
ctggttagcg ggctcgttgc cgtcgcacca gtcgcgcacg cggcggtgac tctcaaagcg 120
cagtataaga caatgattc ggcgccgagt gacaaccaga tcaaaccggg tctccagttg 180
gtgaataccg ggtcgtcgtc ggtggatttg tcgacggtga cggtgcggta ctggttcacc 240
cgggatggtg ggtcgtcgac actggtgtac aactgtgact gggcggcgat ggggtgtggg 300
aatatccgcg cctcgttcgg ctcggtgaac ccggcgacgc cgacggcgga cacctacctg 360
cagttgtcgt tcactggtgg aacgttggcc gctggtgggt cgacgggtga gattcaaaac 420
cgggtgaata agagtgactg gtcgaacttt gatgagacca atgactactc gtatgggacg 480
aacaccacct tccaggactg gacgaaggtg acggtgtacg tcaacggcgt gttggtctgg 540
gggaccgaac cgtccggagc gacggcgtct ccatccgcgt cggcgacgcc cagcccgtcc 600
agttcaccga ccacgagtcc gagttcgtcc cgtcgccga gcagcagccc gacgccgaca 660
ccgagcagct cgtcgccgcc ccgtcgtcca cgacccgta catccagcgg ttcctcacga 720
tgtacaacaa gattcacgac ccagcgaacg gctacttcag cccgcaggga attccctacc 780
actcggtaga aacgctcatc gttgaggcac cggactacgg cacgagaca acttcggagg 840
cgtacagctt ctggctctgg ctcgaagcga cgtacggcgc agtgaccggc aactggacgc 900
cgttcaacaa cgcctggacg acgatggaaa cgtacatgat cccgcagcac gcggaccagc 960
cgaacaacgc gtcgtacaac cccaacagcc cggcgtcgta cgctccggaa gagccgctgc 1020
ccagcatgta cccggttgcc atcgacagca gcgtgccggt tgggcacgac ccgctcgccg 1080
ccgaattgca gtcgacgtac ggcactccgg acatttacgg catgcactgg ctggccgacg 1140
ttgacaacat ctacggatac ggcgacagcc ccggcggtgg ttgcgaactc ggtccttccg 1200
ctaagggcgt ctcctacatc aacacattcc agcgcggctc gcaggagtcc gtctgggaga 1260
cggtcaccca gccgacgtgc gacaacggca agtacggtgg ggcgcacggc tacgtcgacc 1320
tgttcatcca gggttcgacg ccgccgcagt ggaagtacac cgatgccccg gacgccgacg 1380
cccgtgccgt ccaggctgcg tactgggcct acacctgggc atcggcgcag ggcaaggcaa 1440
gcgcgattgc cccgacgatc gccaaggcga gccaaaccgg cgactacctg cggtactcgc 1500
tctttgacaa gtacttcaag caggtcggca actgctaccc ggccagctcc tgccctggag 1560
caaccggacg ccagagcgag acctacctga tcggctggta ctacgcctgg ggcggctcaa 1620
gccaaggctg ggcctggcgc attggtgacg gcgccgcgca cttcggctac agaatccgc 1680
ttgccgcgtg ggcgatgtcg aacgtgacac cgctcattcc gctctcgccc acggcaaaga 1740
gcgactgggc ggcgagcttg cagcgccagc tggagttcta ccagtggttg caatccgcgg 1800
aaggagccat tgcgggcggc gccaccaaca gctggaacgg caattacggg accccgccgg 1860
ccggagactc gaccttctac ggcatggcgt acgactggga gccggtctac cacgacccgc 1920
cgagcaacaa ctggttcggc ttccaggcgt ggtccatgga acgggttgcc gagtactact 1980
acgtcaccgg cgacccgaag gccaaggcgc tgctcgacaa gtgggtcgca tgggtgaagc 2040
cgaatgtcac caccggtgcc tcatggtcga ttccgtcgaa tttgtcctgg agcggccaac 2100
cggataccctg gaatccgagc aacccaggaa cgaatgccaa cctgcacgtg accatcacgt 2160
cgtccgggca ggacgtcggt gttgccgcgg cgctcgcgaa gacactcgag tactacgcgg 2220
caaaatccgg cgatacggcc tcgcgcgacc tcgcgaaggg attgctcgac tccatgtgga 2280

```
acaacgacca ggacagcctc ggtgtgagca caccggagac gcggaccgac tactctcggt 2340
tcactcaggt gtacgacccg acgactggtg acggcctcta catcccgtcg ggttggacgg 2400
ggaccatgcc caacggtgac caaatcaagc cgggtgcgac cttcctgagc atccggtcct 2460
ggtacaccaa ggatccgcag tggtcgaagg tgcaggcgta cctcaacggc gggcctgctc 2520
cgacgttcaa ctaccaccgg ttctgggcgg agtccgactt cgcgatggcg aacgccgatt 2580
ttggcatgct cttcccatcc gggtcgccca gcccgacccc gagcccgact ccgacgtcgt 2640
ccccgagccc gactccgagc agctcgccga cgccgtcgcc cagcccgtca ccgaccggcg 2700
acaccacgcc gccgagcgtg ccgacgggtc ttcaggtcac cgggacaacg acgtcgtccg 2760
tgtcgctcag ctggaccgcg tccaccgaca acgtcggcgt cgcgcactac aacgtgtacc 2820
gaaacggcac gctggtgggt cagccgacag cgacgtcgtt cacggacacc ggcctggctg 2880
ctggcacgtc gtacacgtac acagtggcgg ccgttgatgc ggccggtaac acgtcggcgc 2940
agagcttcgc cggtgacagc gacgacggca tcgccgtcgc gagcccgtcg ccgagcccga 3000
ctccgacgtc gtccccgagc ccaacgccgt cgccgacacc gtcaccgacg tccaccagcg 3060
gcgcatcgtg cactgctacc tacgttgtca atagcgactg gggtagcggc ttcacgacaa 3120
ccgtgaccgt gacgaacacc ggcaccaggg ccaccagtgg ctggacggtc acgtggagct 3180
ttgccggtaa tcagacggtc accaactact ggaacaccgc gctgacgcaa tccggaaagt 3240
cggtgaccgc aaagaacctg agttacaaca cgtcatcca acctggtcag tcgacgacct 3300
ttggattcaa cggaagttac tcaggaacaa acaccgcgcc gacgctcagc tgcacggcaa 3360
gctga                                                             3365


<210> 3
<211> 34
<212> PRT
<213> Acidothermus cellulolyticus


<400> 3
Met Pro Gly Leu Arg Arg Arg Leu Arg Ala Gly Ile Val Ser Ala Ala
  1               5                  10                  15


Ala Leu Gly Ser Leu Val Ser Gly Leu Val Ala Val Ala Pro Val Ala
             20                  25                  30


His Ala




<210> 4
<211> 153
<212> PRT
<213> Acidothermus cellulolyticus


<400> 4
Ala Val Thr Leu Lys Ala Gln Tyr Lys Asn Asn Asp Ser Ala Pro Ser
  1               5                  10                  15


Asp Asn Gln Ile Lys Pro Gly Leu Gln Leu Val Asn Thr Gly Ser Ser
             20                  25                  30


Ser Val Asp Leu Ser Thr Val Thr Val Arg Tyr Trp Phe Thr Arg Asp
             35                  40                  45


Gly Gly Ser Ser Thr Leu Val Tyr Asn Cys Asp Trp Ala Ala Met Gly
     50                  55                  60


Cys Gly Asn Ile Arg Ala Ser Phe Gly Ser Val Asn Pro Ala Thr Pro
 65                  70                  75                  80
```

Thr Ala Asp Thr Tyr Leu Gln Leu Ser Phe Thr Gly Gly Thr Leu Ala
                85   90   95

Ala Gly Gly Ser Thr Gly Glu Ile Gln Asn Arg Val Asn Lys Ser Asp
              100   105   110

Trp Ser Asn Phe Asp Glu Thr Asn Asp Tyr Ser Tyr Gly Thr Asn Thr
              115   120   125

Thr Phe Gln Asp Trp Thr Lys Val Thr Val Tyr Val Asn Gly Val Leu
        130   135   140

Val Trp Gly Thr Glu Pro Ser Gly Ala
145   150

<210> 5
<211> 640
<212> PRT
<213> Acidothermus cellulolyticus

<400> 5
Asn Asp Pro Tyr Ile Gln Arg Phe Leu Thr Met Tyr Asn Lys Ile His
  1   5   10   15

Asp Pro Ala Asn Gly Tyr Phe Ser Pro Gln Gly Ile Pro Tyr His Ser
              20   25   30

Val Glu Thr Leu Ile Val Glu Ala Pro Asp Tyr Gly His Glu Thr Thr
            35   40   45

Ser Glu Ala Tyr Ser Phe Trp Leu Trp Leu Glu Ala Thr Tyr Gly Ala
        50   55   60

Val Thr Gly Asn Trp Thr Pro Phe Asn Asn Ala Trp Thr Thr Met Glu
65   70   75   80

Thr Tyr Met Ile Pro Gln His Ala Asp Gln Pro Asn Asn Ala Ser Tyr
                85   90   95

Asn Pro Asn Ser Pro Ala Ser Tyr Ala Pro Glu Glu Pro Leu Pro Ser
              100   105   110

Met Tyr Pro Val Ala Ile Asp Ser Ser Val Pro Val Gly His Asp Pro
              115   120   125

Leu Ala Ala Glu Leu Gln Ser Thr Tyr Gly Thr Pro Asp Ile Tyr Gly
        130   135   140

Met His Trp Leu Ala Asp Val Asp Asn Ile Tyr Gly Tyr Gly Asp Ser
145   150   155   160

Pro Gly Gly Gly Cys Glu Leu Gly Pro Ser Ala Lys Gly Val Ser Tyr
              165   170   175

Ile Asn Thr Phe Gln Arg Gly Ser Gln Glu Ser Val Trp Glu Thr Val

180   185   190

Thr Gln Pro Thr Cys Asp Asn Gly Lys Tyr Gly Gly Ala His Gly Tyr
        195   200   205

Val Asp Leu Phe Ile Gln Gly Ser Thr Pro Pro Gln Trp Lys Tyr Thr
        210   215   220

Asp Ala Pro Asp Ala Asp Ala Arg Ala Val Gln Ala Ala Tyr Trp Ala
225   230   235   240

Tyr Thr Trp Ala Ser Ala Gln Gly Lys Ala Ser Ala Ile Ala Pro Thr
                245   250   255

Ile Ala Lys Ala Ser Gln Thr Gly Asp Tyr Leu Arg Tyr Ser Leu Phe
                260   265   270

Asp Lys Tyr Phe Lys Gln Val Gly Asn Cys Tyr Pro Ala Ser Ser Cys
        275   280   285

Pro Gly Ala Thr Gly Arg Gln Ser Glu Thr Tyr Leu Ile Gly Trp Tyr
        290   295   300

Tyr Ala Trp Gly Gly Ser Ser Gln Gly Trp Ala Trp Arg Ile Gly Asp
305   310   315   320

Gly Ala Ala His Phe Gly Tyr Gln Asn Pro Leu Ala Ala Trp Ala Met
                325   330   335

Ser Asn Val Thr Pro Leu Ile Pro Leu Ser Pro Thr Ala Lys Ser Asp
                340   345   350

Trp Ala Ala Ser Leu Gln Arg Gln Leu Glu Phe Tyr Gln Trp Leu Gln
        355   360   365

Ser Ala Glu Gly Ala Ile Ala Gly Gly Ala Thr Asn Ser Trp Asn Gly
        370   375   380

Asn Tyr Gly Thr Pro Pro Ala Gly Asp Ser Thr Phe Tyr Gly Met Ala
385   390   395   400

Tyr Asp Trp Glu Pro Val Tyr His Asp Pro Pro Ser Asn Asn Trp Phe
                405   410   415

Gly Phe Gln Ala Trp Ser Met Glu Arg Val Ala Glu Tyr Tyr Tyr Val
        420   425   430

Thr Gly Asp Pro Lys Ala Lys Ala Leu Leu Asp Lys Trp Val Ala Trp
        435   440   445

Val Lys Pro Asn Val Thr Thr Gly Ala Ser Trp Ser Ile Pro Ser Asn
        450   455   460

Leu Ser Trp Ser Gly Gln Pro Asp Thr Trp Asn Pro Ser Asn Pro Gly
465   470   475   480

Thr Asn Ala Asn Leu His Val Thr Ile Thr Ser Ser Gly Gln Asp Val

Gly Val Ala Ala Ala Leu Ala Lys Thr Leu Glu Tyr Tyr Ala Ala Lys
        500   505   510

Ser Gly Asp Thr Ala Ser Arg Asp Leu Ala Lys Gly Leu Leu Asp Ser
        515   520   525

Met Trp Asn Asn Asp Gln Asp Ser Leu Gly Val Ser Thr Pro Glu Thr
        530   535   540

Arg Thr Asp Tyr Ser Arg Phe Thr Gln Val Tyr Asp Pro Thr Thr Gly
545   550   555   560

Asp Gly Leu Tyr Ile Pro Ser Gly Trp Thr Gly Thr Met Pro Asn Gly
                565   570   575

Asp Gln Ile Lys Pro Gly Ala Thr Phe Leu Ser Ile Arg Ser Trp Tyr
                580   585   590

Thr Lys Asp Pro Gln Trp Ser Lys Val Gln Ala Tyr Leu Asn Gly Gly
        595   600   605

Pro Ala Pro Thr Phe Asn Tyr His Arg Phe Trp Ala Glu Ser Asp Phe
        610   615   620

Ala Met Ala Asn Ala Asp Phe Gly Met Leu Phe Pro Ser Gly Ser Pro
625   630   635   640

<210> 6
<211> 85
<212> PRT
<213> Acidothermus cellulolyticus

<400> 6
Asp Thr Thr Pro Pro Ser Val Pro Thr Gly Leu Gln Val Thr Gly Thr
  1   5   10   15

Thr Thr Ser Ser Val Ser Leu Ser Trp Thr Ala Ser Thr Asp Asn Val
            20   25   30

Gly Val Ala His Tyr Asn Val Tyr Arg Asn Gly Thr Leu Val Gly Gln
            35   40   45

Pro Thr Ala Thr Ser Phe Thr Asp Thr Gly Leu Ala Ala Gly Thr Ser
    50   55   60

Tyr Thr Tyr Thr Val Ala Ala Val Asp Ala Ala Gly Asn Thr Ser Ala
65   70   75   80

Gln Ser Phe Ala Gly
                85

<210> 7

<211> 101
<212> PRT
<213> Acidothermus cellulolyticus

<400> 7
Gly Ala Ser Cys Thr Ala Thr Tyr Val Val Asn Ser Asp Trp Gly Ser
 1   5   10   15

Gly Phe Thr Thr Thr Val Thr Val Thr Asn Thr Gly Thr Arg Ala Thr
            20   25   30

Ser Gly Trp Thr Val Thr Trp Ser Phe Ala Gly Asn Gln Thr Val Thr
         35   40   45

Asn Tyr Trp Asn Thr Ala Leu Thr Gln Ser Gly Lys Ser Val Thr Ala
    50   55   60

Lys Asn Leu Ser Tyr Asn Asn Val Ile Gln Pro Gly Gln Ser Thr Thr
 65   70   75   80

Phe Gly Phe Asn Gly Ser Tyr Ser Gly Thr Asn Thr Ala Pro Thr Leu
            85   90   95

Ser Cys Thr Ala Ser
            100

<210> 8
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
      histidine tag

<400> 8
His His His His His His
 1   5

<210> 9
<211> 638
<212> PRT
<213> Acidothermus cellulolyticus

<400> 9
Pro Tyr Ile Gln Arg Phe Leu Thr Met Tyr Asn Lys Ile His Asp Pro
 1   5   10   15

Ala Asn Gly Tyr Phe Ser Pro Gln Gly Ile Pro Tyr His Ser Val Glu
            20   25   30

Thr Leu Ile Val Glu Ala Pro Asp Tyr Gly His Glu Thr Thr Ser Glu
         35   40   45

Ala Tyr Ser Phe Trp Leu Trp Leu Glu Ala Thr Tyr Gly Ala Val Thr

	50				55				60			

Gly Asn Trp Thr Pro Phe Asn Asn Ala Trp Thr Thr Met Glu Thr Tyr
65   70   75   80

Met Ile Pro Gln His Ala Asp Gln Pro Asn Asn Ala Ser Tyr Asn Pro
           85   90   95

Asn Ser Pro Ala Ser Tyr Ala Pro Glu Glu Pro Leu Pro Ser Met Tyr
          100   105   110

Pro Val Ala Ile Asp Ser Ser Val Pro Val Gly His Asp Pro Leu Ala
          115   120   125

Ala Glu Leu Gln Ser Thr Tyr Gly Thr Pro Asp Ile Tyr Gly Met His
          130   135   140

Trp Leu Ala Asp Val Asp Asn Ile Tyr Gly Tyr Gly Asp Ser Pro Gly
145   150   155   160

Gly Gly Cys Glu Leu Gly Pro Ser Ala Lys Gly Val Ser Tyr Ile Asn
          165   170   175

Thr Phe Gln Arg Gly Ser Gln Glu Ser Val Trp Glu Thr Val Thr Gln
          180   185   190

Pro Thr Cys Asp Asn Gly Lys Tyr Gly Gly Ala His Gly Tyr Val Asp
          195   200   205

Leu Phe Ile Gln Gly Ser Thr Pro Pro Gln Trp Lys Tyr Thr Asp Ala
          210   215   220

Pro Asp Ala Asp Ala Arg Ala Val Gln Ala Ala Tyr Trp Ala Tyr Thr
225   230   235   240

Trp Ala Ser Ala Gln Gly Lys Ala Ser Ala Ile Ala Pro Thr Ile Ala
          245   250   255

Lys Ala Ser Gln Thr Gly Asp Tyr Leu Arg Tyr Ser Leu Phe Asp Lys
          260   265   270

Tyr Phe Lys Gln Val Gly Asn Cys Tyr Pro Ala Ser Ser Cys Pro Gly
          275   280   285

Ala Thr Gly Arg Gln Ser Glu Thr Tyr Leu Ile Gly Trp Tyr Tyr Ala
          290   295   300

Trp Gly Gly Ser Ser Gln Gly Trp Ala Trp Arg Ile Gly Asp Gly Ala
305   310   315   320

Ala His Phe Gly Tyr Gln Asn Pro Leu Ala Ala Trp Ala Met Ser Asn
          325   330   335

Val Thr Pro Leu Ile Pro Leu Ser Pro Thr Ala Lys Ser Asp Trp Ala
          340   345   350

Ala Ser Leu Gln Arg Gln Leu Glu Phe Tyr Gln Trp Leu Gln Ser Ala

355   360   365

Glu Gly Ala Ile Ala Gly Gly Ala Thr Asn Ser Trp Asn Gly Asn Tyr
    370   375   380

Gly Thr Pro Pro Ala Gly Asp Ser Thr Phe Tyr Gly Met Ala Tyr Asp
385   390   395   400

Trp Glu Pro Val Tyr His Asp Pro Pro Ser Asn Asn Trp Phe Gly Phe
                405   410   415

Gln Ala Trp Ser Met Glu Arg Val Ala Glu Tyr Tyr Tyr Val Thr Gly
            420   425   430

Asp Pro Lys Ala Lys Ala Leu Leu Asp Lys Trp Val Ala Trp Val Lys
            435   440   445

Pro Asn Val Thr Thr Gly Ala Ser Trp Ser Ile Pro Ser Asn Leu Ser
    450   455   460

Trp Ser Gly Gln Pro Asp Thr Trp Asn Pro Ser Asn Pro Gly Thr Asn
465   470   475   480

Ala Asn Leu His Val Thr Ile Thr Ser Ser Gly Gln Asp Val Gly Val
                485   490   495

Ala Ala Ala Leu Ala Lys Thr Leu Glu Tyr Tyr Ala Ala Lys Ser Gly
            500   505   510

Asp Thr Ala Ser Arg Asp Leu Ala Lys Gly Leu Leu Asp Ser Met Trp
            515   520   525

Asn Asn Asp Gln Asp Ser Leu Gly Val Ser Thr Pro Glu Thr Arg Thr
            530   535   540

Asp Tyr Ser Arg Phe Thr Gln Val Tyr Asp Pro Thr Thr Gly Asp Gly
545   550   555   560

Leu Tyr Ile Pro Ser Gly Trp Thr Gly Thr Met Pro Asn Gly Asp Gln
                565   570   575

Ile Lys Pro Gly Ala Thr Phe Leu Ser Ile Arg Ser Trp Tyr Thr Lys
                580   585   590

Asp Pro Gln Trp Ser Lys Val Gln Ala Tyr Leu Asn Gly Gly Pro Ala
    595   600   605

Pro Thr Phe Asn Tyr His Arg Phe Trp Ala Glu Ser Asp Phe Ala Met
    610   615   620

Ala Asn Ala Asp Phe Gly Met Leu Phe Pro Ser Gly Ser Pro
625   630   635

<210> 10
<211> 640
<212> PRT

<213> Cellulomonas fimi

<400> 10

```
Glu Tyr Ala Gln Arg Phe Leu Ala Gln Tyr Asp Lys Ile Lys Asp Pro
 1               5                  10                  15

Ala Asn Gly Tyr Phe Ser Ala Gln Gly Ile Pro Tyr His Ala Val Glu
                20                  25                  30

Thr Leu Met Val Glu Ala Pro Asp Tyr Gly His Glu Thr Thr Ser Glu
            35                  40                  45

Ala Tyr Ser Tyr Trp Leu Trp Leu Glu Ala Leu Tyr Gly Gln Val Thr
        50                  55                  60

Gln Asp Trp Ala Pro Leu Asn His Ala Trp Asp Thr Met Glu Lys Tyr
65                  70                  75                  80

Met Ile Pro Gln Ser Val Asp Gln Pro Thr Asn Ser Phe Tyr Asn Pro
                85                  90                  95

Asn Ser Pro Ala Thr Tyr Ala Pro Glu Phe Asn His Pro Ser Ser Tyr
            100                 105                 110

Pro Ser Gln Leu Asn Ser Gly Ile Ser Gly Gly Thr Asp Pro Ile Gly
        115                 120                 125

Ala Glu Leu Lys Ala Thr Tyr Gly Asn Ala Asp Val Tyr Gln Met His
    130                 135                 140

Trp Leu Ala Asp Val Asp Asn Ile Tyr Gly Phe Gly Ala Thr Pro Gly
145                 150                 155                 160

Ala Gly Cys Thr Leu Gly Pro Thr Ala Thr Gly Thr Ser Phe Ile Asn
            165                 170                 175

Thr Phe Gln Arg Gly Pro Gln Glu Ser Val Trp Glu Thr Val Pro Gln
            180                 185                 190

Pro Ser Cys Glu Glu Phe Lys Tyr Gly Gly Lys Asn Gly Tyr Leu Asp
            195                 200                 205

Leu Phe Thr Lys Asp Ala Ser Tyr Ala Lys Gln Trp Lys Tyr Thr Ser
    210                 215                 220

Ala Ser Asp Ala Asp Ala Arg Ala Val Glu Ala Val Tyr Trp Ala Asn
225                 230                 235                 240

Gln Trp Ala Thr Glu Gln Gly Lys Ala Ala Asp Val Ala Ala Thr Val
            245                 250                 255

Ala Lys Ala Ala Lys Met Gly Asp Tyr Leu Arg Tyr Thr Leu Phe Asp
            260                 265                 270

Lys Tyr Phe Lys Lys Ile Gly Cys Thr Ser Pro Thr Cys Ala Ala Gly
        275                 280                 285
```

```
Gln Gly Arg Glu Ala Ala His Tyr Leu Leu Ser Trp Tyr Met Ala Trp
    290                 295                 300

Gly Gly Ala Thr Asp Thr Ser Ser Gly Trp Ala Trp Arg Ile Gly Ser
305                 310                 315                 320

Ser His Ala His Phe Gly Tyr Gln Asn Pro Leu Ala Ala Trp Ala Leu
                325                 330                 335

Ser Thr Asp Pro Lys Leu Thr Pro Lys Ser Pro Thr Ala Lys Ala Asp
                340                 345                 350

Trp Ala Ala Ser Met Gln Arg Gln Leu Glu Phe Tyr Thr Trp Leu Gln
                355                 360                 365

Ala Ser Asn Gly Gly Ile Ala Gly Gly Ala Thr Asn Ser Trp Asp Gly
    370                 375                 380

Ala Tyr Ala Gln Pro Pro Ala Gly Thr Pro Thr Phe Tyr Gly Met Gly
385                 390                 395                 400

Tyr Thr Glu Ala Pro Val Tyr Val Asp Pro Pro Ser Asn Arg Trp Phe
                405                 410                 415

Gly Met Gln Ala Trp Gly Val Gln Arg Val Ala Glu Leu Tyr Tyr Ala
                420                 425                 430

Ser Gly Asn Ala Gln Ala Lys Lys Ile Leu Asp Lys Trp Val Pro Trp
                435                 440                 445

Val Val Ala Asn Ile Ser Thr Asp Gly Ala Ser Trp Lys Val Pro Ser
    450                 455                 460

Glu Leu Lys Trp Thr Gly Lys Pro Asp Thr Trp Asn Ala Ala Ala Pro
465                 470                 475                 480

Thr Gly Asn Pro Gly Leu Thr Val Glu Val Thr Ser Tyr Gly Gln Asp
                485                 490                 495

Val Gly Val Ala Ala Asp Thr Ala Arg Ala Leu Leu Phe Tyr Ala Ala
                500                 505                 510

Lys Ser Gly Asp Thr Ala Ser Arg Asp Lys Ala Lys Ala Leu Leu Asp
                515                 520                 525

Ala Ile Trp Ala Asn Asn Gln Asp Pro Leu Gly Val Ser Ala Val Glu
    530                 535                 540

Thr Arg Gly Asp Tyr Lys Arg Phe Asp Asp Thr Tyr Val Ala Asn Gly
545                 550                 555                 560

Asp Gly Ile Tyr Ile Pro Ser Gly Trp Thr Gly Thr Met Pro Asn Gly
                565                 570                 575

Asp Val Ile Lys Pro Gly Val Ser Phe Leu Asp Ile Arg Ser Phe Tyr
                580                 585                 590
```

Lys Lys Asp Pro Asn Trp Ser Lys Val Gln Thr Phe Leu Asp Gly Gly
        595   600   605

Ala Glu Pro Gln Phe Arg Tyr His Arg Phe Trp Ala Gln Thr Ala Val
        610   615   620

Ala Gly Ala Leu Ala Asp Tyr Ala Arg Leu Phe Asp Asp Gly Thr Thr
625   630   635   640

<210> 11
<211> 642
<212> PRT
<213> Thermobifida fusca

<400> 11
Ser Tyr Asp Gln Ala Phe Leu Glu Gln Tyr Glu Lys Ile Lys Asp Pro
 1   5   10   15

Ala Ser Gly Tyr Phe Arg Glu Phe Asn Gly Leu Leu Val Pro Tyr His
            20   25   30

Ser Val Glu Thr Met Ile Val Glu Ala Pro Asp His Gly His Gln Thr
        35   40   45

Thr Ser Glu Ala Phe Ser Tyr Tyr Leu Trp Leu Glu Ala Tyr Tyr Gly
    50   55   60

Arg Val Thr Gly Asp Trp Lys Pro Leu His Asp Ala Trp Glu Ser Met
65   70   75   80

Glu Thr Phe Ile Ile Pro Gly Thr Lys Asp Gln Pro Thr Asn Ser Ala
                85   90   95

Tyr Asn Pro Asn Ser Pro Ala Thr Tyr Ile Pro Glu Gln Pro Asn Ala
            100   105   110

Asp Gly Tyr Pro Ser Pro Leu Met Asn Asn Val Pro Val Gly Gln Asp
            115   120   125

Pro Leu Ala Gln Glu Leu Ser Ser Thr Tyr Gly Thr Asn Glu Ile Tyr
    130   135   140

Gly Met His Trp Leu Leu Asp Val Asp Asn Val Tyr Gly Phe Gly Phe
145   150   155   160

Cys Gly Asp Gly Thr Asp Asp Ala Pro Ala Tyr Ile Asn Thr Tyr Gln
            165   170   175

Arg Gly Ala Arg Glu Ser Val Trp Glu Thr Ile Pro His Pro Ser Cys
            180   185   190

Asp Asp Phe Thr His Gly Gly Pro Asn Gly Tyr Leu Asp Leu Phe Thr
            195   200   205

Asp Asp Gln Asn Tyr Ala Lys Gln Trp Arg Tyr Thr Asn Ala Pro Asp
    210   215   220

```
Ala Asp Ala Arg Ala Val Gln Val Met Phe Trp Ala His Glu Trp Ala
225             230             235                 240

Lys Glu Gln Gly Lys Glu Asn Glu Ile Ala Gly Leu Met Asp Lys Ala
            245             250                 255

Ser Lys Met Gly Asp Tyr Leu Arg Tyr Ala Met Phe Asp Lys Tyr Phe
            260             265             270

Lys Lys Ile Gly Asn Cys Val Gly Ala Thr Ser Cys Pro Gly Gly Gln
        275             280             .   285

Gly Lys Asp Ser Ala His Tyr Leu Leu Ser Trp Tyr Tyr Ser Trp Gly
    290             295             300

Gly Ser Leu Asp Thr Ser Ser Ala Trp Ala Trp Arg Ile Gly Ser Ser
305             310             315                 320

Ser Ser His Gln Gly Tyr Gln Asn Val Leu Ala Ala Tyr Ala Leu Ser
            325             330             335

Gln Val Pro Glu Leu Gln Pro Asp Ser Pro Thr Gly Val Gln Asp Trp
        340             345             350

Ala Thr Ser Phe Asp Arg Gln Leu Glu Phe Leu Gln Trp Leu Gln Ser
        355             360             365

Ala Glu Gly Gly Ile Ala Gly Gly Ala Thr Asn Ser Trp Lys Gly Ser
    370             375             380

Tyr Asp Thr Pro Pro Thr Gly Leu Ser Gln Phe Tyr Gly Met Tyr Tyr
385             390             395                 400

Asp Trp Gln Pro Val Trp Asn Asp Pro Pro Ser Asn Asn Trp Phe Gly
            405             410             415

Phe Gln Val Trp Asn Met Glu Arg Val Ala Gln Leu Tyr Tyr Val Thr
        420             425             430

Gly Asp Ala Arg Ala Glu Ala Ile Leu Asp Lys Trp Val Pro Trp Ala
        435             440             445

Ile Gln His Thr Asp Val Asp Ala Asp Asn Gly Gly Gln Asn Phe Gln
    450             455             460

Val Pro Ser Asp Leu Glu Trp Ser Gly Gln Pro Asp Thr Trp Thr Gly
465             470             475                 480

Thr Tyr Thr Gly Asn Pro Asn Leu His Val Gln Val Val Ser Tyr Ser
            485             490             495

Gln Asp Val Gly Val Thr Ala Ala Leu Ala Lys Thr Leu Met Tyr Tyr
        500             505             510

Ala Lys Arg Ser Gly Asp Thr Thr Ala Leu Ala Thr Ala Glu Gly Leu
    515             520             525
```

```
Leu Asp Ala Leu Leu Ala His Arg Asp Ser Ile Gly Ile Ala Thr Pro
    530                 535             540

Glu Gln Pro Ser Trp Asp Arg Leu Asp Asp Pro Trp Asp Gly Ser Glu
545                 550                 555                 560

Gly Leu Tyr Val Pro Pro Gly Trp Ser Gly Thr Met Pro Asn Gly Asp
                565                 570                 575

Arg Ile Glu Pro Gly Ala Thr Phe Leu Ser Ile Arg Ser Phe Tyr Lys
            580                 585                 590

Asn Asp Pro Leu Trp Pro Gln Val Glu Ala His Leu Asn Asp Pro Gln
        595                 600                 605

Asn Val Pro Ala Pro Ile Val Glu Arg His Arg Phe Trp Ala Gln Val
    610                 615                 620

Glu Ile Ala Thr Ala Phe Ala Ala His Asp Glu Leu Phe Gly Ala Gly
625                 630                 635                 640

Ala Pro
```